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A=440 PITCH ADOPTED

PITCH *versus* TEMPERATURE

By J. C. DEAGAN

THERE has been considerable controversy regarding the adoption of A =440 as the Official Pitch of the American Federation of Musicians and as is always the case in matters of this kind, there have been a number of protests from various sources, the protesters, with only a cursory knowledge of the subject, claiming that raising the pitch from A =435, the former Standard Low Pitch, to A =440 would necessitate the purchasing of new instruments by musicians, and would result in chaos in general.

The purpose of this article is to prove conclusively that the adoption of A =440 as the Official Pitch of the American Federation of Musicians is merely the bestowal of official recognition upon the low pitch which has ALWAYS been used in bands and orchestras in this country since low pitch was adopted. In order that there may be no doubt as to the authenticity of this statement, I propose to offer a number of arguments and references to prove my contention.

Musicians and instrument manufacturers who insist that A =435 is the correct low pitch fail to take into consideration the fact that the French Government Commission in the official draft stipulated that the pitch should be A =435 vibrations set in a temperature of 15 degrees Centigrade (59 degrees Fahrenheit), but it was not their intention to provide a fork or any other mechanism tuned to this pitch in this temperature.

All they did was to specify the number of vibrations and the number of degrees of temperature. It naturally follows that instruments tuned to A =435 at a temperature of 59 degrees Fahrenheit will raise in pitch to A =440, or very close to it, when used under normal temperature conditions (68 to 72 degrees Fahrenheit). This is the reason that the pitch of A =440 is very often mistaken for A =435 and is fully explained further along in this article.

American made clarinets, flutes, etc., have been on the market but a comparatively short time. Naturally, therefore, a large majority of the flutes and clarinets and all of the oboes, English-horns, etc., used in bands and orchestras are European made. As it is the clarinet (or the oboe where used) to which the rest of the instruments are usually tuned, the pitch of the clarinet (or the oboe) is generally the pitch of the entire band or orchestra. Musicians do not generally consider the lower toned instruments in this respect as they should. Deep toned instruments are less susceptible to change of Pitch by bodily heat of the player than small instruments on account of the larger caliber of the deeper toned instruments containing a much greater quantity of air than the smaller instruments.

American instrument makers who attempted to tune their product to A =435, at what we consider normal temperature (68 to 72 degrees Fahrenheit) soon found out their error, as from all sources they received the complaint "Your instruments are too flat!" Rather than jeopardize their reputation in this respect the progressive manufacturers soon switched over to A =440 and have since received practically no complaints regarding pitch.

Piano tuners, also, who have tuned pianos to A =435 for orchestra use have almost invariably been assailed with the cry from clarinet players that the pitch was too low. Many, many times has the tuner then called in the clarinetist so that he could tune the piano up to his "A" and satisfy him. And in practically every instance the piano tuner has explained this condition of affairs by stating that the pitch of the clarinet was "entirely too sharp," failing to grasp, as has a large part of the piano and organ industry, that A =440 is the true low pitch under normal temperature conditions, and not A =435.

In the following paragraphs I believe I have proven that A =440 is the true low pitch, and I hope the entire article will be given that attention which I feel it deserves in view of the vital subject of which it treats. Speaking from the vocalists' or string instrument players' standpoint, the pitch question is a subject which affects vocalists and violinists more than any one, as an ever varying pitch ruins the musical ear.

The delicacies of intonation are only to be acquired after long experience and acquaintance with a fixed pitch; therefore, if an artist uses various pitches, how can he be expected to play or sing perfectly in tune? It is a most severe test, and one that should not exist. Hence, so few musicians can not tell MENTALLY, which pitch, or the exact pitch, they are using.

In changing the frequency of International Pitch vibrations from A =435 to A =440 the American Federation of Musicians has not really changed the pitch at all. In reality it has only made a change in the temperature in which the pitch should be played. Years ago we demonstrated the extent to which temperature changes the pitch of wind instruments in a band or orchestra. It was a demonstration that can be made by any good band or orchestra that cares to try it.

Sound travels faster and farther in one second of time if the temperature is 72 degrees Fahrenheit than it does if the temperature is 59 degrees Fahrenheit, i. e., more sound vibrations strike the ear in a second of time in warm weather than in cool weather, the source having the same number of vibrations in both cases.

This is a basic law of nature—analogous to the higher sounds of an approaching and the lower sounds of a receding railway train.

The demonstration above referred to had to do with orchestras which had warmed up and tuned to A =435 at the temperature of 15 degrees Centigrade (59 degrees Fahrenheit). The same orchestras in the same room with the atmosphere warming up to 20 degrees Centigrade (68 degrees Fahrenheit) went up to a pitch fully four vibrations above the A =435 fork, or in other words, to A =439. The fork, also warmer, had lowered a fraction of a vibration, but this was really negligible. (A good A =440 tuning fork lowers in pitch only one vibration with a raise in temperature of 33 degrees Fahrenheit, and vice versa).

The official pitch of France (which the French call "Diapason Normal" and which we have been in the habit of calling "International Pitch") is A =435, which is set at a temperature of 15 degrees Centigrade (59 degrees Fahrenheit). It is to be regretted that this pitch was set at such a low temperature. It is this fact that caused all the difficulty in regard to pitch and tuning later on.

The American public is not accustomed to a temperature anywhere near as low as that which the French Government Commission stipulates "Is the correct degree of heat at which the official pitch of A =435 must be set." Theodore Thomas, as far back as 1883, ordered his concert-halls to be kept at a temperature of 72 degrees Fahrenheit, or as near that temperature as possible.

In America we insist on a temperature of at least 70 degrees Fahrenheit and this often goes as high as 76 degrees Fahrenheit, and higher in concert-halls. A wise plan would be to have one pitch and one temperature—the right temperature and keep it normal. A temperature of 76 degrees would send the same orchestras, above referred to, to a pitch even higher than A =440.

Along the same lines, when a band plays on a hot day in summertime it will be found that the pitch is considerably above A =440. So in adopting A =440 we are really not changing the pitch at all. It is simply a matter of difference in temperature in which the pitch is played and which raises wind instruments five vibrations, equal to less than one-fifth of a semi-tone, which is a very slight change.

Cold sends the pitch of wind instruments down (considerably flatter). On the other hand, cold sends the pitch of string instruments up (slightly sharper). So an even, steady temperature is necessary in order that the wind and strings stay in the same pitch. Tuning and playing should be done in the same temperature.

The cooler the temperature the more difficult it is for wind instruments to stay in tune with themselves, especially small metal instruments, which will not hold the heat when out of contact with the body, like wooden instruments do. All wind instruments should have an even bore slide, so that they can be slightly adjusted a shade above normal or a shade below normal in case of climatic changes or overheating.

It is unfortunate that teachers of acoustics (theory) have very little to say on the question of temperature. Temperature was not considered of much practical importance even in Helmholtz's day.

In the year 1885 the great "World's Congress of Musicians" met in Vienna. One of their proceedings was to settle the pitch question for all time to come.

In their protocol they adopted the French "Diapason Normal," A =435, at 15 degrees Centigrade (59 degrees Fahrenheit) as the universal pitch for the whole world. This protocol was the document which made the A =435 so popular everywhere. UNIFORMITY OF PITCH was what the world wanted.

Leading orchestras in Vienna and other cities tried to use this pitch at that low temperature, but without success. The temperature was too cool for musicians and audience in Vienna. They then changed the temperature from 15 degrees Centigrade to 24 degrees Centigrade (from 59 degrees Fahrenheit to 75.2 degrees Fahrenheit). This change increased the vibration frequency of the inital standard. The fork remained at 435 vibrations, but the "A" of the brass, woodwind and organ went above A =440.

This higher temperature made the "A" of the wind instruments too sharp, so they afterwards reduced the temperature, then increased it again.

Prof. Blaserna's report at the Congress—that a wind instrument tuned to A =435 at 15 degrees Centigrade, warmed up to 35 degrees Centigrade, went to an untempered semi-tone or B♭ =457.7—went unheeded.

These experiments were sometimes comical, at other times pitiful, and after three years of fiddling around they went back to their old pitch, which most of the old musicians nearly always had used since the days of the master Beethoven and which is still in use to the present day—A =440. (See my article in the June, 1917, number of the *International Musician*, entitled "How pitch raised in Vienna in Beethoven's day").

In 1895, the Philharmonic Society Orchestra of London, England, an orchestra of mixed nationalities, adopted the French pitch of A =435 at 15 degrees Centigrade (59 degrees Fahrenheit) and actually tried to use it. But it would not work. (They had been using a pitch which Sir Michael Costa was responsible for in 1848, called "English Pitch"—A =454).

So the following year, in 1896, the Philharmonic Society adopted A =439 at 20 degrees Centigrade (68 degrees Fahrenheit) and called it the new "Philharmonic Pitch." They have been using that pitch ever since.

There was a general protest at the time and hundreds of letters were published in the newspapers against the change; many people in the music business "actually thought they would be ruined." "It would put the music trade out of business; pianos would not sound so good; voices could not change; old violins would be ruined," etc., etc. (See the proceedings of the Philharmonic Society for those two years, 1895, 1896. Also a book called *Musical Pitch*, published in London by "Waterlow & Sons, Ltd.," 49 Parliament St., Westminster, in which the whole question is aired, *pro* and *con*).

The Paris Opera orchestra and other leading musical organizations have had an experience somewhat similar to that of the Vienna and London orchestras. The writer has tested the pitch of nearly every leading orchestra in Europe and America. Not one of them uses a pitch so low as A =435. Many of them do not use the pitch they claim they use.

In view of the foregoing facts, therefore, the pitch of A =440 may safely be declared to be the low pitch which is in use to-day.

There may be extremes of low temperature when wind instruments fall below this pitch, but there are fully as many times when the excessive heat sends them considerably above A =440.

In the long run, however, and in the large majority of instances when musicians are playing under normal temperature conditions of this country, A = 440, or very near it, has been the low pitch in actual use for years.

Hence, in adopting A = 440 as the standard pitch we are not adopting a new pitch. We are simply acknowledging as correct the pitch which we have been unconsciously using since "low pitch" was adopted.[1]

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[1] For further information I would recommend musicians to try the following experiment for themselves:

Get an A= 435 tuning fork, (and be sure that it is a guaranteed Standard A= 435). Reduce the temperature of your room to 59 degrees Fahrenheit and let your wind instrument and fork stand in that temperature for an hour or two. Then adjust your wind instrument to the A= 435 fork. Now you are exactly in tune with the fork. Then let the room warm up to 72 degrees Fahrenheit, letting the wind instrument and fork stand in this temperature for a couple of hours. Now try and see if you are not about five vibrations higher than the A=435 fork or up to A=440. Large wind instruments are better for this experiment, as they are less affected by the heat of the body than small instruments, which can be overheated.

I believe this experiment will be very instructive, if not convincing. In this connection I want to add that in actual playing best results would be obtained if the small instruments would try to keep in tune with the larger ones, as the pitch of the latter is not so changeable as that of the small ones.

It may be of interest to note that Mr. Joseph Winkler, President of the Chicago Federation of Musicians, Local No. 10, wanted each delegate attending the National Convention (held in Chicago, May 13th, 1918), to have something unique as a souvenir that would be typical of Chicago, something not produced in other cities where Conventions are held.

Mr. Winkler saw to it that each of the hundreds of delegates carried home to his Local, with the compliments of the Chicago Federation of Musicians, a Deagan "A=440 Tuning Fork" and a Deagan "A=440 Studio Wall Chart."

The Dea-Gan-Ometer, made for the Bureau of Standards, Washington, D. C., a scientific mechanism which proves the accuracy of A=440, or any other pitch, was exhibited at the Convention for the edification of the Delegates. I may add that this instrument apparently aroused their appreciative interest.